



UTILISATION OF BLOOD COMPONENTS IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Transfusion of blood components such as Packed Red Cell (PRC), Fresh Frozen Plasma (FFP) and platelet concentrates (PC) play an important role as a supportive therapy. This study was performed to study the utilisation and appropriateness of blood components in clinical practice at a tertiary care hospital-based blood bank at GMC, Jammu.

Materials and Methods: A prospective analysis of blood components was conducted over a period of one year from November 2012 to October 2013. The usage of different types of blood component were recorded and correlated with the patient's diagnosis and indications for transfusion. The appropriate use of blood components were assessed by DGHS guidelines.

Results: Of the total 17634 units of blood components issued over a period of 1 year, 58.14% were Packed Red Cells (PRC), 29.43% were Fresh Frozen Plasma (FFP), 12.25% were Platelet Concentrate (PC) and 0.18% were Cryoprecipitate. The appropriate use of Packed Red Cells was 90.33% whereas inappropriate use was 9.67%. Inappropriate use of PRC was mostly seen in patients with minor bleeding without significant changes in hemoglobin level and in patients with asymptomatic chronic anemia with Hb > 7g/dl. For Fresh Frozen Plasma 80.66% usage was appropriate and 19.34% were used inappropriately. Use of FFP for volume expansion was the most frequent form of inappropriate use followed by cases of bleeding without derangement of coagulation tests. For Platelet Concentrate 93.29% transfusions were utilized appropriately and 6.71% inappropriately. Inappropriate use of PC was mostly seen in patients who had received platelets prophylactically with platelet count above 10,000/ μ l.

Conclusion: Periodic review of blood component usage is very important to access the blood utilization pattern and judicious implementation of guidelines for use of blood components would decrease their inappropriate use.

Key Words: Packed red cell, Platelet concentrates, Fresh frozen plasma, Appropriate

INTRODUCTION

Over the last few decades transfusion medicine has underwent marked changes. Contrary to use of whole blood, emphasis is given on the use of specific blood components for appropriate and rational use of blood. The blood component implies separation of whole blood into various components like packed red cells, platelet concentrates, fresh frozen plasma and cryoprecipitate.¹

Blood transfusion forms an important part of various treatment protocols. Blood must be transfused cautiously in view of its propensity to cause adverse effects such as introduction of donor antigens in the recipient, transfusion reactions or exposure to various transfusion transmitted diseases. The indications for ordering blood must be fully justified to avoid

misuse or overuse of this precious resource. Periodic review of blood component usage is essential to assess the blood utilization pattern².

Appropriate use of blood components results in cost effective transfusion therapy and reduces transfusion related complications³. With the advent of blood component usage for specific needs of patients better guidelines have been suggested and put into practice. It is now a standard practice to manufacture and use different blood components from donated whole blood⁴.

The current study was prospectively carried out in the Department of Transfusion Medicine at Government medical college (GMC) Jammu from November 2012 to October 2013. It was aimed at studying the utilisation and appropri-

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ateness of various blood components in clinical practice.

MATERIALS AND METHODS:

Prospective analysis of blood component requisitions in patients from different clinical departments of GMC, Jammu were reviewed regarding age, sex, blood group, diagnosis, investigations, indication for transfusion, number of units issued and the speciality prescribing it. The usage of different types of blood component were recorded and correlated with the patient's diagnosis and indications for transfusion. The appropriate use of blood components were assessed by Directorate General of Health Services (DGHS-2003) guidelines.

Indications of packed red cells (PRC):

- Surgery: Patient requiring urgent operation with Hb < 10g/dl.
- Anticipated surgical blood loss > 1000 ml.
- Acute blood loss of 30-40% of blood volume or more.
- Anemia associated with incipient or established cardiac failure.
- Hb value < 6 g/dl in the absence of disease and between 8 and 10 g/dl with disease.
- Patients approaching delivery and having Hb value < 7 g/dl.
- In hereditary hemolytic anemias and beta thalassemia major, guidelines are more liberal.

Indications of Platelet concentrate (PC):

- Platelet count is < 5000 / μ l regardless of clinical condition.
- Platelet count is 5000-10,000 / μ l, if there is increased risk of bleeding due to hematological malignancies, sepsis, severe aplastic anemia or patients undergoing bone marrow transplant.
- Platelet count is 10,000-20,000/ μ l, if thrombocytopenic bleeding or microvascular bleeding is present.
- Chemotherapy of malignancy (decreased production), if platelet count \leq 20,000/ μ l.
- Disseminated intravascular coagulation (increased destruction), if platelet count is \leq 50,000/ μ l.
- Massive transfusion (platelet dilution), if platelet count is \leq 50,000/ μ l.
- In major surgery if the platelet count is <70,000 - 80,000/ μ l.
- Prophylactically for patients who have platelet count <10,000/ μ l to prevent bleeding.

Indications of Fresh Frozen Plasma (FFP):

- Actively bleeding and multiple coagulation factors deficiencies in
 - o Liver diseases

- o Disseminated intravascular coagulation (DIC)
- o Dilutional coagulopathy in massive blood transfusion.
- o When specific disorder cannot be or has not yet been identified.
- Deficiency of Factors II, VII, IX and X or reversal of coumarin drug effect.
- Antithrombin III deficiency.
- Congenital or acquired coagulation factor deficiency.
- Laboratory parameters: PT/PTT > 1.5 \times Normal.

Indications of Cryoprecipitate:

- Hemophilia A.
- Von Willebrand's disease.
- Congenital or acquired fibrinogen deficiency.
- Acquired Factor VIII deficiency (e.g. DIC, massive transfusion).
- Factor XIII deficiency.
- Source of Fibrin Glue used as topical hemostatic agent in surgical procedures.

Statistical analysis: Data from blood component requisition forms of Department of Transfusion Medicine was collected, coded, tabulated, analysed and expressed as percentage.

RESULTS

Out of total 10980 transfusion requests, 17634 transfusion units for different blood components were issued. For PRC 8649 (78.77%) transfusion requests were received and 10252 (58.14%) units were issued with an average of 1.18 units per patient. For FFP 1482 (13.50%) transfusion requests were received and 5190 (29.43%) units were issued with an average of 3.50 units per patient. For PC 843 (7.68%) transfusion requests were received and 2161 (12.25%) units were issued with an average of 2.56 units per patient. For Cryoprecipitate 6 (0.05%) transfusion requests were received and 31 (0.18%) units were issued with average of 5.16 units per patient.

Of total 10980 transfusion requests received 6283 (57.22%) were for males and 4697 (42.78%) were for females. Maximum number of requests 4293 (39.10%) were between 0-15 years of age, 1889 (17.20%) were between 16-30 years, 1372 (12.50%) were between 31-45 years, 1306 (11.90%) were between 46-60 years and 2120 (19.30%) were above 60 years of age. Of total requisitions received 2537 (23.10%) were for A+ve, 3589 (32.69%) were for B+ve, 3156 (28.74%) were for O+ve, 939 (8.55%) were for AB+ve, 190 (1.73%) were for A-ve, 241 (2.20%) were for B-ve, 230 (2.10%) were for O-ve and 98 (0.89%) were for AB-ve.

Table 1: Utilisation of blood components as per different specialities.

Speciality	PRC		FFP		PC	
	N	(%)	N	(%)	N	(%)
Medicine and allied	1624	(15.84)	1056	(20.35)	903	(41.79)
Accident & Emergency	2054	(20.03)	1045	(20.13)	321	(14.85)
Obstetrics and Gynaecology	1518	(14.81)	470	(9.06)	157	(7.27)
Pediatrics	1027	(10.02)	278	(5.36)	305	(14.11)
Surgery and allied	841	(8.20)	1293	(24.91)	109	(5.04)
ICU	616	(6.01)	1048	(20.19)	366	(16.94)
Thalassemia ward	2572	(25.09)	-	-	-	-
Total	10252	(100)	5190	(100)	2161	(100)

Of total 10252 PRCs, highest number of units 2572 (25.09%) were utilised in Thalassemia ward followed by Accident & Emergency 2054 (20.03%). Of total 5190 FFPs, highest number of units 1293 (24.91%) were utilised in Surgery and allied specialities followed by Medicine and allied specialities 1056 (20.35%). Of total 2161 PCs, highest number of units 903 (41.79%) were utilised in Medicine and allied specialities followed by ICU 366 (16.94%).

Table 2: Distribution of appropriate and inappropriate use of blood components

Component	Appropriate		Inappropriate		Total	
	n	(%)	n	(%)	N	%
Packed red cells	9261	(90.33)	991	(9.67)	10252	(100)
Fresh frozen plasma	4186	(80.66)	1004	(19.34)	5190	(100)
Platelet concentrate	2016	(93.29)	145	(6.71)	2161	(100)
Cryoprecipitate	31	(100)	0	(0)	31	(100)
Total	15494	(87.86)	2140	(12.14)	17634	(100)

Of the total 17634 components issued 15494 (87.86%) were used appropriately and 2140 (12.14%) were used inappropriately. Out of 10252 PRC units issued 9261 (90.33%) were appropriate and 991 (9.67%) were inappropriate. Out of 5190 FFP units issued 4186 (80.66%) were appropriate and 1004 (19.34%) were inappropriate. Out of 2161 PC units issued 2016 (93.29%) were appropriate and 145 (6.71%) were inappropriate. There was no inappropriate episode of cryoprecipitate transfusion.

Table 3: Appropriate and Inappropriate use of PRC, FFP and PC as per different specialities.

Speciality	PRC		FFP		PC	
	Appropriate n (%)	Inappropriate n (%)	Appropriate n (%)	Inappropriate n (%)	Appropriate n (%)	Inappropriate n (%)
Medicine and allied	1497 (92.18)	127 (7.82)	859 (81.34)	197 (18.66)	823 (91.14)	80 (8.86)
Accident & Emergency	1719 (83.69)	335 (16.31)	790 (75.60)	255 (24.40)	295 (91.90)	26 (8.10)
Obstetrics and Gynaecology	1180 (77.73)	338 (22.27)	379 (80.64)	91 (19.36)	149 (94.90)	8 (5.10)
Pediatrics	960 (93.48)	67 (6.52)	241 (86.69)	37 (13.31)	290 (95.08)	15 (4.92)
Surgery and allied	758 (90.13)	83 (9.87)	984 (76.10)	309 (23.90)	104 (95.41)	5 (4.59)
ICU	596 (96.75)	20 (3.25)	933 (89.03)	115 (10.97)	355 (97.00)	11 (3.00)
Thalassemia ward	2551 (99.18)	21 (0.82)	-	-	-	-
Total	9261 (90.33)	991 (9.67)	4186 (80.66)	1004 (19.34)	2016 (93.29)	145 (6.71)

For PRC highest percentage of appropriate episodes 99.18% (2551/2572) were observed in Thalassemia ward followed by ICU 96.75% (596/616), while as highest percentage of inappropriate episodes 22.27% (338/1518) were observed in Obstetrics and Gynaecology followed by Accident & Emergency 16.31% (335/2054).

For FFP highest percentage of appropriate episodes 89.03% (933/1048) were observed in ICU followed by pediatrics 86.69% (241/278), while as highest percentage of inappropriate episodes 24.40% (255/1045) were observed in Accident & Emergency followed by Surgery and allied specialties 23.90% (309/1293).

For PC highest percentage of appropriate episodes 97% (355/366) were observed in ICU while as highest percentage of inappropriate episodes 8.86% (80/903) were observed in Medicine and allied specialities followed by Accident & Emergency 8.10% (26/321).

Table 4: Packed red cells (PRC) requests as per disease condition.

Appropriate disease conditions	PRC requests N (%)
Thalassemia and other haemolytic anemias	2698 (31.19)
Leukemias / Malignancies / Aplastic anemia	1427 (16.50)
Severe bleeding (medical / surgical / traumatic)	1359 (15.71)
Symptomatic chronic anemia / CKD	1038 (12.00)
Delivery with preoperative Hb < 7g/dl	804 (9.30)
Surgery with preoperative Hb < 10g/dl	441 (5.10)
Other disease conditions	43 (0.50)
Inappropriate disease conditions	
Mild bleeding (medical / surgical / traumatic)	268 (3.10)
Asymptomatic chronic anemia with Hb > 7g/dl	225 (2.60)
Preoperative transfusion to raise Hb > 10g/dl	199 (2.30)
Indication of transfusion not mentioned	147 (1.70)
Total	8649 (100)

Table 5: Fresh frozen plasma (FFP) requests as per disease indication.

Appropriate disease conditions	FFP requests N (%)
Liver disease with bleeding	410 (27.67)
Coagulopathy in surgical patients	317 (21.39)
DIC with evidence of bleeding	206 (13.90)
Neonatal sepsis with DIC	120 (8.10)
Bleeding with excessive warfarin therapy	79 (5.33)
Haemorrhagic disease of newborn	41 (2.77)
Inappropriate disease conditions	
Hypovolumia / As volume expander	102 (6.88)
Bleeding with normal coagulation test results	78 (5.26)
Hypoproteinemia	39 (2.63)
Indication of transfusion not mentioned	90 (6.07)
Total	1482 (100)

Table 6: Platelets concentrate (PC) request as per disease indication.

Appropriate disease conditions	PC requests N (%)
Hematological malignancy with risk of bleeding	295 (35.00)
Dengue with bleeding / platelet count <20,000/ μ l	144 (17.08)
Surgical / invasive procedures with platelet count <70,000/ μ l	135 (16.01)
DIC with platelet count <50,000/ μ l	124 (14.71)
ITP with life threatening bleeding	80 (9.49)
Inappropriate disease conditions	
Prophylactically with platelet count >10,000/ μ l	27 (3.20)
Surgical / invasive procedures with platelet count >70,000/ μ l	17 (2.02)
ITP / TTP without life threatening bleeding	10 (1.19)
Indication of transfusion not mentioned	11 (1.30)
Total	843 (100)

DISCUSSION

Blood component therapy allows several patients to benefit from one unit of donated whole blood. Blood and blood products are considered drugs by the food and drug admin-

istration (FDA). Just like any other treatment strategy with pros and cons, blood transfusions should only be administered if the benefits outweigh the risks⁵.

As a fact the supply of blood and blood components are finite, a high rate of inappropriate use has been reported around the world. This inappropriate use of blood and its components have a significant impact on the patients and the hospital staff in the form of health care cost, wastage of resources, depriving more needy patients and transmission of infection with unnecessary allergic reaction leading to high mortality and morbidity in patients^{6,7}.

In the current study of the total 17634 components issued 15494 (87.86%) were used appropriately and 2140 (12.14%) were used inappropriately. The rates of inappropriate use of blood components reported by most studies vary widely, and it is difficult to compare rates because of differences in the criteria used to define appropriate and inappropriate use. Each blood product will be discussed separately because of the variety of reasons for transfusing packed red cells, fresh frozen plasma and platelets.

Packed Red Cells (PRC):

The number of requests received for packed cells were 8649 (78.77%) and number of units issued were 10252 (58.14%) with average of 1.18 units per patient. Of 10252 units of PRC issued, 90.33% belonged to a group of appropriate use and 9.67% were used inappropriately. Metz et al⁸ found 10-16% of transfusion units were given inappropriately and Mozes et al.⁹ reported a much higher rate of inappropriate use of PRCs.

Maximum appropriate use of PRC (99.18%) was in patients with thalassemia followed by ICU patients (96.75%). It may be due to the fact that in beta thalassemia major, guidelines for transfusion are more liberal and in ICU proper transfusion guidelines may have been followed. Obstetrics and Gynaecology department (22.27%) followed by Accident and Emergency department (16.31%) were the main inappropriate users of PRC.

Transfusions of packed red blood cells was found to be inappropriate in patients with evidence of bleeding but without significant changes in hemoglobin level, in patients with asymptomatic chronic anemia with Hb > 7 g/dl and in patients who had received transfusions preoperatively to raise Hb > 10 g/dl.. In many instances a low hemoglobin or hematocrit is used to determine a request for a transfusion of packed red cells but the correct approach is to combine the laboratory criteria and the symptoms of the patient. Clinical transfusion therapy relies on clinical experience and investigation. Recently, new evidence-based transfusion guidelines ("triggers") have been promoted to rationalise blood utilisation and reduce harmful transfusion complications¹⁰.

Fresh Frozen Plasma (FFP):

The number of requests for FFP were 1482 (13.50%) and number of units issued were 5190 (29.43%) with average of 3.50 units per patient. It is recommended to transfuse 5-6 units of FFP to correct the haemostatic defect due to clotting factor deficiency¹¹. Of these 5190 units of FFP 80.66% belonged to a group of appropriate use and 19.34% were used inappropriately. Percentage of inappropriate use of FFP was high compared to other blood products. Drastic reduction in the use of whole blood has been reported as the origin of inappropriate use of FFP¹². There are many reports available regarding inappropriate transfusion of FFP at various centres showing 29% to 40% FFP being used inappropriately^{13, 14, 15} which was higher as compared to our study.

We found maximum inappropriate use of FFP in Accident and Emergency department (24.40%) followed by Surgery and allied specialities (23.90%). A coagulation deficiency determination must be performed before request for FFP is made. FFP was given inappropriately as a volume expander, in cases of bleeding without derangement of coagulation tests and in patients of hypoproteinemia. A misconception about FFP that, it is a good volume expander and a source of albumin does not hold true.

In our experience, we found two common reasons behind the inappropriate use of FFP. Some clinicians were not aware of the guidelines, while some clinicians tend to use FFP as a "precaution" against litigations and disputes. Kakkar et al.¹⁶ indicated 60.3% FFP prescriptions were inappropriate which however got reduced to 26.6% after educational campaigns of clinicians. In present study 6.07% of patients appeared to have been given FFP for reasons not clearly specified. Comparable data has been reported at national and international levels.^{17, 18, 19} FFP sometimes is still over-prescribed and strict clinical criteria for the utilisation of FFP need to be enforced. To establish an appropriate use of FFP, all requests needs to be sufficed with the indications for FFP as well as the patients Partial Thromboplastin Time (PT) / Activated Partial Thromboplastin Time (APTT) and International Normalized Ratio (INR) values.

Platelet Concentrate (PC):

The total number of platelet requests received were 843 (7.68%) and number of units issued were 2161 (12.25%) with average of 2.56 units per patient. We found that 93.29% of the platelet transfusions were utilized appropriately and 6.71% inappropriately. Inappropriate use of platelets was seen mostly in Medicine and allied specialities (8.86%) followed by Accident and emergency (8.10%). Makroo et al²⁰ found about 19% of platelet transfusions were given at values in the order of $50-100 \times 10^9/L$ and significant percentage of blood request forms were incomplete.

The goal of the platelet transfusions is to prevent severe and life threatening bleeding in patients with thrombocytopenia. This aim needs to be balanced against the risk associated with platelet transfusions as well as the challenge of maintaining an adequate supply.²¹ In present study inappropriate use of platelets was seen in patients who have received platelets prophylactically with platelet count above 10,000/ μ l, in surgical or invasive procedures with platelet count > 70,000/ μ l, in ITP / TTP without life threatening bleeding. Estcourt et al.²² found 34% of prophylactic transfusions were inappropriate which was higher as compared to our study. It is believed that the use of prophylactic platelet transfusions to keep the platelet count above $10 \times 10^9/L$ reduces the risk of haemorrhage as effectively as keeping it above any higher level.²³ On the other hand, in the presence of factors such as fever or infection, ongoing chemotherapy, concurrent coagulopathy, rapid fall in platelet counts or in the presence of potential bleeding sites as a result of surgery, the use of platelet transfusions to keep the count above $20 \times 10^9/L$ is clinically justified.²⁴

During the last two decades all over the world platelet utilization has increased more than the use of any other blood components.²⁵ On one hand, the ready availability of platelet concentrates has undoubtedly made a major contribution to modern clinical practice in allowing the development of intense treatment regimens for hematological or other malignancies and on the other hand inappropriate use is also prevalent.²⁶

CONCLUSION

Periodic review of blood component usage is very important to access the blood utilization pattern in any hospital. Judicious implementation of guidelines for use of various blood components would help decrease their inappropriate use. This will not only ensure availability of proper components to needy patients but simultaneously decrease transfusion related reactions as well. Awareness and education among all treating doctors, establishment of guidelines and regular audit will help in increasing the appropriate use of blood components.

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